Proposed Changes to Missing E_T

- What is wrong with MET?
- New met_analyze package
- New MET variable sets
- Rough sketch of new MET object

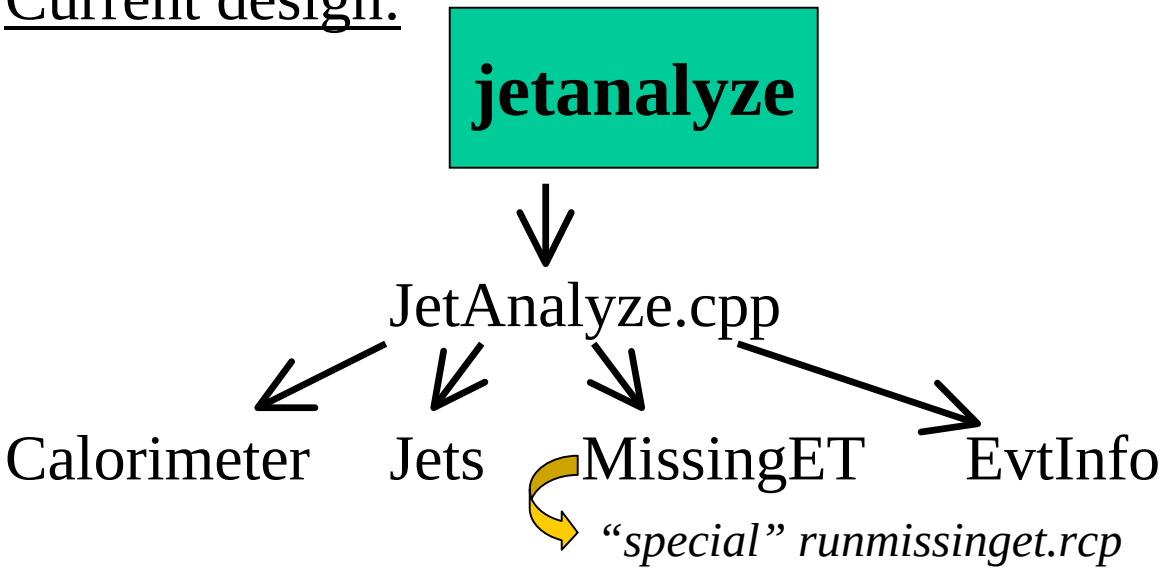
Alan L. Stone - Louisiana Tech University

Why Change MET?

- It's a Hack!
  - More Fortran & C-like than object-based
- At least 8 "authors" in five years
  - Different & uncoordinated style
- Structure is too rigid
  - PMCS copy constructor
  - Adding variable(s) →too complicated
- Confusing variable names
  - What does METNE or MEyWE mean?

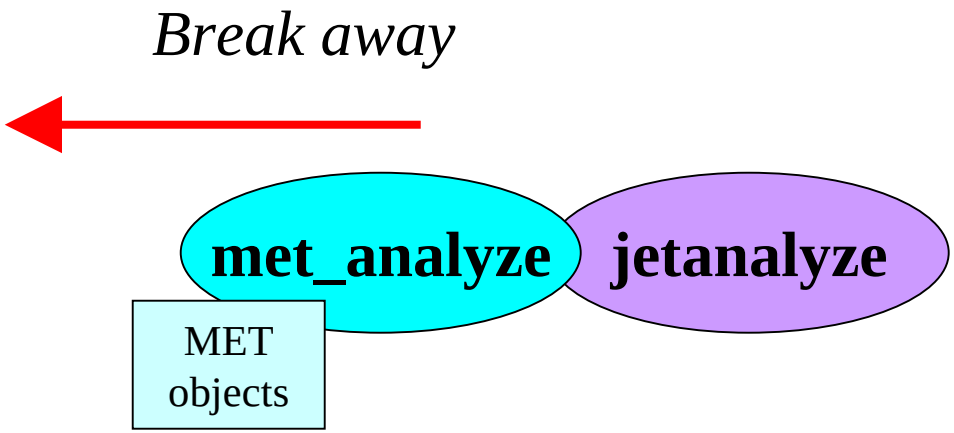
New met_analyze package

Current design:



analyze	bcjet_analyze
bphys_analyze	caep_analyze
cal_nada_analyze	calanalyze
chpart_analyze	d0_analyze
em_analyze	fe_crate_analyze
fps_analyze	gtr_analyze
jetanalyze	l1cal_analyze
l1frm_analyze	l1ft_analyze
l1muo_analyze	l2calem_analyze
l2caljet_analyze	l2calmet_analyze
l2cps_analyze	l2cttcft_analyze
l2gbl_analyze	l2gblem_analyze
l2mu_analyze	l2stt_analyze
l3fanalyze	l3fsmtanalyze
l3fvertex_analyze	l3prop_analyze
mc_analyze	mccomb_analyze
met_analyze	muo_analyze
nada_analyze	prop_analyze
reco_analyze	semanalyze
smt_analyze	tau_analyze
trig_jetanalyze	trigsim_analyze
vertex_analyze	wz_analyze

Proposed design:



Date: Thu, 06 Dec 2001 13:31:55 -0600
From: Alan M Jonckheere <jonckheere@fnal.gov>
Subject: Re: Package request: met_analyze

done. NOTE: to have an exe stay around after a release is "frozen", you need to ask that it be saved (we get rid of >10GB of "junk" per build (5/10 builds per week) by cleaning out unasked for exes. I need: exe name *exact* + short (< 1 line) description of what it does.
Alan

> Hi Alan,
>
> Package name: met_analyze
> Package purpose: METAnalyze would be the framework package that produces an Ntuple for
> missingET. This is currently done in JetAnalyze. The Jets/MET convenors and I have
> agreed that it makes sense to separate missingET from JetAnalyze.
> Authors: Alan L. Stone - alstone@fnal.gov
> Joe Steele - steele@fnal.gov
> Lee Sawyer - sawyer@fnal.gov
> thanks, alan

New MET Variable Scheme

- Only one MET object is needed
  - instantiate several times
    - Towers
      - » Cal + ICD
      - » ICD only
      - » eta limits
      - » tower energy thresholds
      - » PMCS ?

New MET Variable Scheme
continued

- Cells
  - » Cal + ICD
  - » ICD only
  - » eta limits
  - » NADA
  - » cell energy thresholds

– Separate object for muon info

– Missing E_T RECO gets list or vector of MET objects

– met_analyze ➡ new variable names only “exist” here

- muon correction is done here

Date: Mon, 19 Nov 2001 23:00:25 +0100 (CET)
From: Gregorio Bernardi <gregorio@in2p3.fr>
To: d0jetmet@fnal.gov
Subject: Upgrade of the MET Block/scheme.

SET: scalar ET obtained as the sum of cell energy*abs(sin(theta)).
    a cell with negative energy will give a NEGATIVE contribution to SET

VETx: x of vect. ET obtained as the sum of the cell energy*sin(th)*cos(ph)
VETy: y of vect. ET obtained as the sum of the cell energy*sin(th)*sin(ph)
VETz: z of vect. ET obtained as the sum of the cell energy*cos(th)
     (in these 3 variables the energy can be positive or negative)

VET=sqrt(VETx**2+VETy**2)

the x and y component of the Missing ET (METx, METy) are simply:
METx=-VETx
METy=-VETy

the missing transverse energy is obtained by
MET=sqrt(METx**2+METy**2) , and of course MET=VET.

in the detailed variables, we use VETx, VETy, VETz in order to have a
symmetric (same sign) treatment of calorimeter and muons:
e.g. VETx=+VETCALOx+VETMUONx, etc..

we first describe a modification when going from the MET block to
the METOLD block, by adding the muon information.

Old MET block New METOLD block (during the transition period)

MET	MET
METx	METx
METy	METy
SET	SET
METNE	METNE
METNEx	METNEx
METNEy	METNEy
SETNE	SETNE
METWE	METWE
METWEx	METWEx
METWEy	METWEy
SETWE	SETWE

MUONx px sum of the "good muons"
MUONy py sum of the "good muons"
MUONSET

Structure of the future MET block

The components of the detailed vectorial variables are stored
at the end of the block. Many combined objects can be created from these
detailed variables by the user at analysis stage but MET variables are
given in this block only for the most common objects. The following
global variables are thus given for analysis use (their definition
in parenthesis refer to the detailed variables listed at the end):

Global variables:

SETT Scalar Et constructed from Cal-ICD Towers (=+SETTAS +SETTBS)
METTx x component constructed from Cal-ICD Towers (=-VETTASx-VETTBSx)
METTy y component constructed from Cal-ICD Towers (=-VETTASy-VETTBSy)
METT Missing Et constructed from Cal-ICD Towers

METTM Scalar Et constructed from Cal-ICD Towers&Muon (+SETT +SETMUON)
METTMx x component constructed from Cal-ICD Towers&Muon (-VETTx-VETMUONx)
METTMy y component constructed from Cal-ICD Towers&Muon (-VETTy-VETMUONy)
METTM Missing Et constructed from Cal-ICD Towers&Muon

SETC Scalar Et constructed from Cal-ICD Cells (+SETCAS +SETCBS)
METCx x component constructed from Cal-ICD Cells (-VETCASx-VETCBSx)
METCy y component constructed from Cal-ICD Cells (-VETCASy-VETCBSy)
METC Missing Et constructed from Cal-ICD Cells

SETCM Scalar Et constructed from Cal-ICD Cells&Muon (+SETC +SETMUON)
METCMx x component constructed from Cal-ICD Cells&Muon (-VETCx-VETMUONx)
METCMy y component constructed from Cal-ICD Cells&Muon (-VETCy-VETMUONy)
METCM Missing Et constructed from Cal-ICD Cells&Muon

Part concerning towers:

SETTAS Scalar sum of Towers Above eta limit and E_tow > twr-thresh.
VETTASx Vectorial sum of Towers Above eta limit and E_tow > twr-thresh.
(the x,y,z components are given, same for all variables below)

SETTBS Scalar sum of Towers Below eta limit and E_tow > twr-thresh.
VETTBSx Vectorial sum of Towers Below eta limit and E_tow > twr-thresh.

SETTAN Scalar sum of Towers Above eta limit and E_tow < twr-thresh.
VETTANx Vectorial sum of Towers Above eta limit and E_tow < twr-thresh.

SETTBN Scalar sum of Towers Below eta limit and E_tow < twr-thresh.
VETTBNx Vectorial sum of Towers Below eta limit and E_tow < twr-thresh.

Part concerning cells:

SETCAS Scalar sum of Cells Above eta limit and E_cell > cel-thresh.
VETCASx Vectorial sum of Cells Above eta limit and E_cell > cel-thresh.

SETCBS Scalar sum of Cells Below eta limit and E_cell > cel-thresh.
VETCBSx Vectorial sum of Cells Below eta limit and E_cell > cel-thresh.

SETCAN Scalar sum of Cells Above eta limit and E_cell < cel-thresh.
VETCANx Vectorial sum of Cells Above eta limit and E_cell < cel-thresh.

SETCBN Scalar sum of Cells Below eta limit and E_cell < cel-thresh.
VETCBNx Vectorial sum of Cells Below eta limit and E_cell < cel-thresh.

Standalone part

SETICD Scalar sum of ICD cells only
VETICDx Vectorial sum of ICD cells only

SETNADAx Scalar sum of NADA cells
VETNADAx Vectorial sum of NADA cells

SETMUONx Scalar sum of MUONs
VETMUONx Vectorial sum of MUONs

end of block

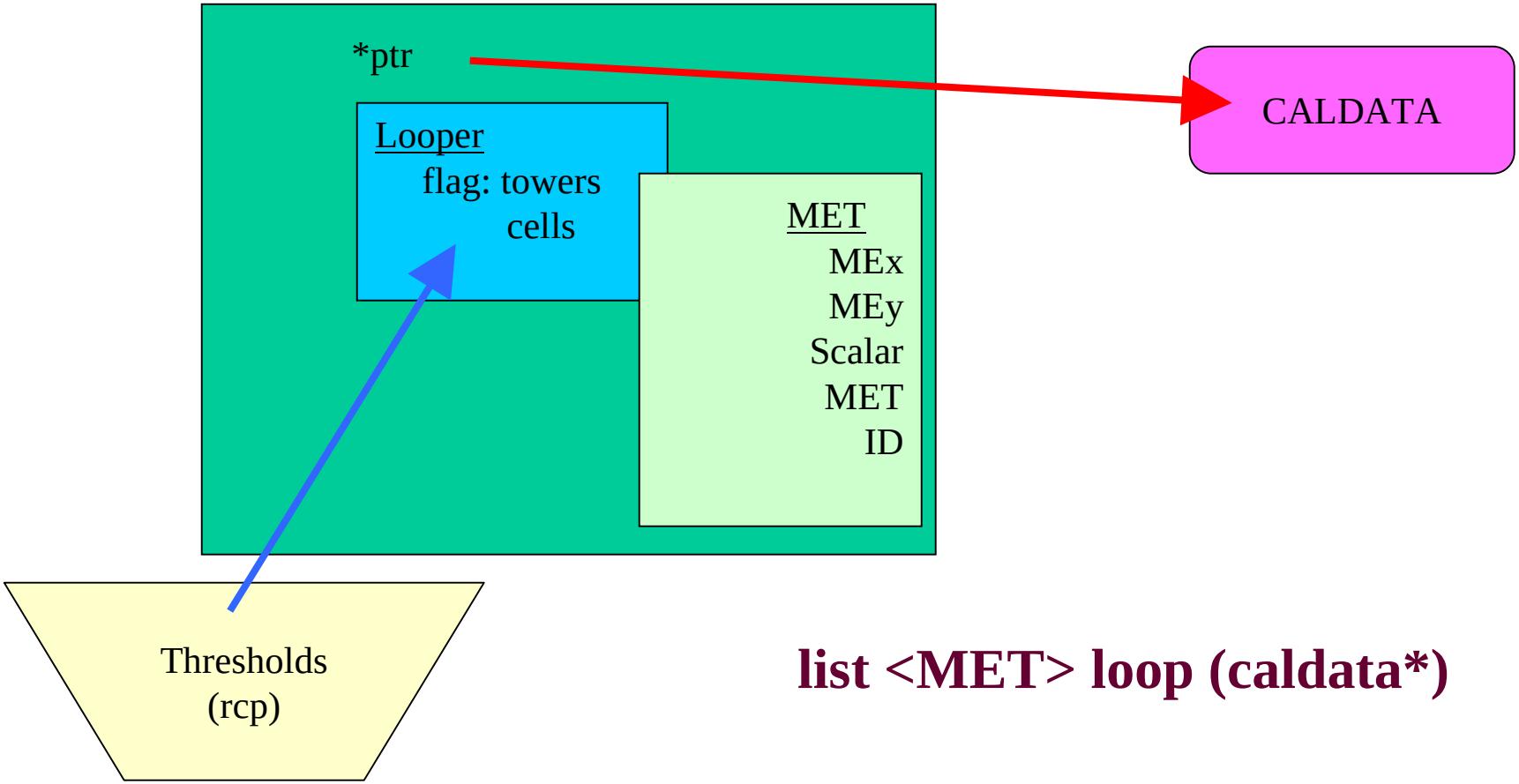
The .....N,ICD,NADA, quantities are given for systematic studies.
They are not used explicitely in the global MET/SET calculations done in this block, since the ICD is already included in the Tower and Cells variables, and since NADA hot cells have already been suppressed. However, if NADA is ran in shadow mode then the NADA quantities can be used to obtain a NADA corrected missing/Scalar ET. Conversely, if NADA has been run in killing mode, the non-NADA corrected MET can be trivially restored using the detailed NADA variables.

The revertexing block corresponds to the VETTAS+VETTBS quantities.
(i.e the total vectorial E_T obtained from towers above tower threshold).

The WE/NE concept of the old MET block is implemented in this scheme by the 2 complementary quantities:
SETTAS (towers above eta limits) SETTBS (towers below eta limit),
i.e. SETT=SETTAS+SETTBS (similary for VETx,y,MET).

Rough Sketch of New MissingET

[thanks to Laurent Duflot & Harry Melanson]



list <MET> loop (caldata*)

- ◆ Only loop over cells or towers once
- ◆ Calorimeter cell occupancy is about 8% per event (Total # Cells ~55000)
- ▼ Calorimeter Event Readout : # Towers ~ # Cells